

INFANT FEEDING

A balanced diet should contain

1. Protein = 15 % " High biological value"
2. Fat = 35% "Essential fatty acids"
3. CHO. = 50%
4. Sufficient amount of

- * Water
- * Electrolytes
- * Vitamins
- * Minerals
- * Trace element

N.B.

1gm	Protein gives	4.1 Cal
1gm	CHO gives	4.1Cal
1gm	Fat gives	9.3 Cal

Types of infant feeding

A. Breast Feeding

1. Mother
2. Wet nurse
3. Breast milk bank

B. Artificial Feeding

1. Fresh animal milks
2. Condensed & Evaporated milks.
3. Dried animal milks

C. Mixed Feeding

1. Complementary $\Rightarrow$ to complete a breast fed.
2. Supplementary $\Rightarrow$ to replace a breast fed.

Work Hard for great success

Physiology of Lactation

At Puberty

The increase in breast size occurs due to the increase of estrogens & progesterone levels.

N.B.

Adequate levels of GH, thyroxin, insulin & glucocorticoids are also important.

During Pregnancy

1. $\uparrow\uparrow\uparrow$ Size $\Rightarrow$ Chorionic somatomotropin
Estrogens.
Progesterone.
2. Proliferation of ducts $\Rightarrow$ Estrogens.
3. Milk Secretion $\Rightarrow$ Prolactin.

After Labor

1. $\Rightarrow$ Sudden $\downarrow\downarrow\downarrow$ in level of estrogens & progesterone $\Rightarrow$ Marked $\uparrow\uparrow\uparrow$ of prolactin $\Rightarrow$ $\oplus$ Alveolar cells $\Rightarrow$ Milk secretion.
2. Suckling $\Rightarrow$ $\oplus$ Nipple & areola $\Rightarrow$ $\uparrow\uparrow\uparrow$ oxytocin $\Rightarrow$ contraction of myo-epithelial cells which line the ducts lead to ejection of milk into lactiferous ducts $\Rightarrow$ "Let down reflex".
3. When the infant is suckling from one side of the breast $\Rightarrow$ Milk may spurt from the nipple not in use. But it can be easily stopped by tapping the nipple.
4. A third reflex, Nipple erection reflex $\Rightarrow$ results from stimulation of the nipple by suckling or tactile stimulation of the nipple.
5. Various cerebral, cortical & hypothalamic conditioned reflexes which are mediated by visual & auditory stimuli or by emotions $\Rightarrow$ All these are known to affect lactation e.g Hunger cry of the infant.

Factors affecting milk production

1) Regular complete evacuation of both breasts:

- ⇒ This is the most important factor for maintenance of milk secretion.
 - a. The more vigorous the suckling, the more the milk secretion.
 - b. Continuous suckling by the infant is necessary for maintaining milk flow.
 - c. Suckling stimulates production of prolactin & oxytocin.

2) Hormones:

Estrogens, progesterone, prolactin, oxytocin, thyroxin & growth hormone. Normal level of these hormones are essential for initiation & maintenance of lactation.

3) Maternal health, Nutrition & Diet:

Physical fitness, good nutrition & good hydration are basic requirements for adequate milk production.

4) Psychological Factors:

- The mother should have a sincere desire to breast fed her baby.
- Psychological disturbances may decrease or even abolish breast milk production.

5) Lactagogues:

- These are agents which increase milk production.
- There is no evidence that they have more than a psychological effect on the mother e.g. Helba, Halawa tehinia vit B.

N.B

**Suckling ⇒ ↑↑↑ Prolactin serum level 10 times & Feeding more than 6 times daily maintains high basal prolactin levels.
Thus early & Frequent suckling are desirable*

Concentrate you can do it

***The Following reflexes are essential
for successful breast feeding.***

**** Infant:***

- 1. Rooting reflex.*
- 2. Suckling reflex*
- 3. Swallowing reflex.*
- 4. Satiety reflex.*

**** Mother:***

- 1. Nipple erection reflex.*
- 2. Milk secretion reflex.*
- 3. Milk ejection reflex*

Breast Feeding

Advantages

A: To the infant:

1. It is biochemically the most suitable product for infant feeding

⇒ It contains the various elements required for nutrition in the proportions optimal for digestion, absorption & body needs" i.e. perfectly balanced".

2. Naturally stored at a suitable temperature & naturally sterile.

3. Available whenever needed & automatically adjusted to infant needs.

4. It has anti-infective properties: Contains secretory antibodies (mostly IgA), lactoferrin, macrophages, lymphocytes complement.

5. Contains Bifidus factors" ⇒ ⊕ Growth of "Lactobacillus bifidus" bacteria

⇒ Minimizes the intestinal colonization with other potentially pathogenic bacteria e.g. E. Coli.

6. It contains specific growth factors for the GIT, CNS & epidermis ⇒ So Breast fed infants thrive better.

7. Breast feeding has a definite psychological advantage for both the baby & mother" maternal - Infant Bonding" Which is essential for optimum emotional development of the baby.

8. It protect against allergic diseases.

9. Proper development of facial muscles.

10. Better achievement of mental development (higher IQ).

B: To the mother:

1 .Cheap

2. Less effort of preparation.

3. Suckling is associated with rapid post-partum involution of the uterus ⇒ due to vigorous uterine contractions induced by release of oxytocin.

4. Emotional satisfaction of the mother.

5. Less incidence of cancer breast.

6 .Natural contraception.

Due to inhibition of ovulation during lactation.

50% of lactating mothers do not ovulate until the child is weaned due to high level of prolactin, which inhibits secretion of pituitary gonadotropins.

Anti-infective properties of breast feeding

A. It is naturally sterile

B. It contains various anti-microbial factors as

1. Antibodies:

Mostly IgA against bacteria & viruses.

They are specially active against:

- E-Coli.
- Shigella
- Salmonella.

So G.E. is less common with BF.

2. Cells:

Phagocytes "granulocytes & macrophages", and

Lymphocytes of both T & B types" Mostly T-cells"

3. Complement:

Which may be involved with secretory IgA $\Rightarrow$ bacteriolysis.

4. Interferon:

$\Rightarrow$ Produced by T- lymphocytes

5. Resistant factors

$\Rightarrow$ against staphylococci

6. Proteins as:

a. Lactoferrin $\Rightarrow$ which binds to iron.

b. B12- binding protein.

Thus preventing their uptake by intestinal bacteria $\Rightarrow$ Good absorption

1.B

Iron is essential for growth & multiplication of E-Coli.

Therefore lactoferrin is considered a bacteriostatic protein for E-Coli

7. Bifidus factor:

$\Rightarrow$ ① Growth of lactobacillus bifidus =

Thus $\Rightarrow$ inhibition of growth of other pathogenic bacteria as E-Coli.

8. Low buffering capacity of breast milk:

$\Rightarrow$ Prevents neutralization of the gastric acidity, which is a natural barrier against infections.

9. Oligosaccharides: prevents attachment of antigens to the epithelium of the GIT.

Contraindications to B.F.

Causes in the mother

A. Absolute

There is no absolute maternal contra-indications to BF except (Cancer breast)

B. Relative

1. Maternal cachectic conditions, chronic poor nutrition & debility.
2. Chronic illness of the mother until controlled e.g.

HF

Active open TB.

Thyrotoxicosis.

Nephritis.

DM.

3. Acute illness of the mother until controlled e.g.

Eclampsia.

Septicemia

Profuse hge

Typhoid fever

Malaria

4. Mental diseases e.g.:

Severe neurosis

Post-Partum psychosis.

Epilepsy.

Except under observation or after control

5. Maternal medications that can pass with milk & harm the baby

e.g.: Cytotoxic drugs

Anti-thyroid drugs.

Radio-active substances.

Cocaine, heroin.

Ergotamine.

Lithium.

6. Local conditions of the breast e.g.:

a. Nipples ⇒ Retraction Inversion

Fissuring or crackling

b. Breast ⇒ Mastitis Abscess

7. Pregnancy

Not a contra-indication during the 1st 20 weeks, After that

fetal growth is marked & deficiency diseases are liable to affect all the 3 persons

↓
Mother

↓
Baby

↓
Fetus

N.B

1. Menstruation is not a contra-indication to BF.
2. Syphilitic mother should nurse her baby because the baby is highly infectious. So, the baby should never be put to the breast of any woman except his mother, which is syphilitic.
3. Tuberculous mother: Maternal CXR.... If abnormal isolate the baby till sputum examination is done..... If +Ve.... INH is given to the baby till sputum of the mother is negative for 3 months then Do tuberculin test to the baby..... if +Ve continue INH for 9-12 months..... if -Ve INH can be stopped.
4. Maternal rubella is not a contraindication.
5. Maternal herpes simplex is a contraindication only if there is active lesions near the nipples.
6. Maternal hepatitis B during pregnancy is not a contraindication if the infant receives at birth hepatitis B vaccine & specific hepatitis B Ig injected at different sites. If the mother acquired infection during nursing the infant should receive accelerated vaccination (0, 1 & 2 months).
7. Maternal AIDS: transmission via breast milk is well documented & is a contraindication if there is a safe alternative.

Causes in the infant

A. Absolute:

Inborn Errors of Metabolism - IEM" as phenylketonuria "PKU", galactosemia & lactose - intolerance ⇒ Breast milk & Animal milks are hazardous & special types of artificial milk are indicated.

B. Relative:

1. Acute illness of the infant

⇒ in these conditions breast milk can be expressed & given to the baby by a spoon or dropper, because BF is too tiring for him.

The same can be done in the presence of congenital anomalies e.g. cleft lip & palate.

2. Breast milk jaundice

⇒ due to presence of 3α, 20-β pregnandiol in breast milk, which is a metabolite of the progesterone ⇒ inhibition of glucuronyl transferase

enzyme which is responsible for conjugation of indirect bilirubin to direct bilirubin

Ttt $\Rightarrow$ stop BF for only 48 hrs then continue it again.

Difficulties in BF

Obstacles in the mother

A. Delayed milk production

As in cases of C.S. & traumatic shocky labor or any cause that delays suckling.

Ttt $\Rightarrow$ If there is marked delay we usually resort to complementary feeding & the baby should suckle the breast first in every fed.

B. Developmental abnormalities

1. Absent or small breast

$\Rightarrow$ give complementary feeding

2. Pendulous breast

$\Rightarrow$ Support the breast during feeding.

3. Absent, small or flat nipples

$\Rightarrow$ If it occurred, breast milk can be expressed & given to the baby. Artificial nipple or breast pump may be used.

C. Painful conditions of the breast

1. Acute milk engorgement

It is painful conditions of the breast occurs in 2nd or 3rd day after birth.

It is due to inadequate suckling of the breast with milk.

The condition can be prevented by regular & complete evacuation of the breast.

Severe conditions can be managed (Parlodol) & stopped when the condition is improved.

Suckling should not be stopped.

2. Mastitis & Breast abscess

$\Rightarrow$ Regular artificial evacuation of the affected side should be done + Antibiotics + hot fomentations

* If abscess is formed $\Rightarrow$ drainage.

3. Fissuring & Cracking of nipples

These can be prevented by:

a. Local cleaning using bland water.

b. Prevent breast engorgement

- c. Prevent prolonged useless suckling.
- d. Keep the nipple dry.
- e. Application of lanolin, panthenol creams enhances healing.

Obstacles in the baby

1. Congenital Anomalies: Cleft lip, Cleft palate micro-gnathia, esophageal atresia, CHD. Etc.
2. Nasal obstruction: bilateral choanal atresia, adenoids, common cold.
3. Painful conditions of mouth: Stomatitis. Oral moniliasis, ulcers & Natal teeth.
4. Birth trauma
5. Prematurity.
6. Pneumonia & other causes of RD
7. Irritable neurotic infants.

Instructions for BF

- * We should explain to every mother the variable advantages of breast feeding over other methods, in addition to the various factors that affect milk production & difficulties of BF
- * A mother willing to breast fed her baby is the key for success.
- * The following instructions are a possible guide to the lactating mother.

I. Initiation of Feeding:

- Should be started as soon as the mother recover from fatigue of labor.
- This is usually within the 1st 6 hrs after labor.
- The baby is put to each breast for about 1-3 mm then the duration is gradually ↑↑

II. Technique of feeding

1. The mother should be sitting in a comfortable position.
2. The nipple & areola should be clean using fresh water "Don't use detergent soap".
3. The baby is hold in a semi-recumbent position on mother's arm, and the breast is held by the index & middle finger of the other hand, with mild gentle squeezing using the thumb.
4. Both breasts should be used at the same fed initially.

- Later on, if milk supply is adequate $\Rightarrow$ Alternate breasts should be used at each fed.
 - If one breast doesn't satisfy the baby $\Rightarrow$ both breasts used first at one fed should be used second at the next fed.
 - It is advised to exhaust one side before shifting to the other breast, because the fat content in the last portion of the fed is higher.
5. At the middle & again at the end of the fed the infant should be raised to a sitting position or held in the erect position to allow air swallowed during suckling to escape from the stomach "Eructation" Why? $\Rightarrow$ to prevent regurgitation of milk.
 6. After feeding, the baby is better put in the prone position, with his face to one side to prevent aspiration if regurgitation occurs.
 7. Boiled water "allowed to cool" may be given to the baby at any time, especially in hot weather.
 8. If supplementary or complementary feeding is needed, care should be taken that only unsweatened milks should be used $\Rightarrow$ because the baby may like it & refuse breast milk.
Also the holes in the bottle teat should not be too wide making it more easy than breast feeding.

III. Duration of feeding

N.B

Initially, the time of suckling is limited to 1-3 mm on each breast, on the 1st day. This period is gradually increased until it is 5-10 minutes on each breast.

1. The baby should not be allowed > 20 minutes / fed $\rightarrow$ Why?
2. Most milk is taken from the breast in the 1st 5 minutes & the baby is often satisfied after 10 minutes

IV. Frequency of feeding

2 methods are used .

A. Demand method

B. Regular O'clock method

A. Demand method

Which is self regulatory method. The feeding started when the baby cries from hunger.

Recently, considered as the best method as it allows him to physiologically regulate his intake. However, it should be noted that all crying is not due to hunger, but it may be due to thirst, soiling colic, cold or a demand for attention should be looked for.

B. Regular O'clock method

The usual schedule is at 3 hourly interval starting at 6 AM till 9 PM, with an additional midnight feeding in the 1st 2 months.

N.B

The frequency of feeding is decreased with age e.g.

- 1) 1st 4 months $\Rightarrow$ Every 3hrs = 6-7 feeds / D
- 2) 4th 10th month $\Rightarrow$ Every 4 hrs = 5 feeds / D
- 3) 10th - 12th month $\Rightarrow$ Every 5 hrs = 4 feeds / D

* The 4 hourly feeding program is indicated in

- 1) Over — weight baby.
- 2) Liberal breast — milk supply
- 3) After the age of 4 months.

* The 2 hourly feeding program is indicated in

- 1) Premature & under weight.
- 2) Scanty breast milk supply.

The Efficiency of milk Supply

This can be evaluated by the following points:

1. The baby looks satisfied after feeding & goes into sleep.
2. Proper gain in weight.
3. No. of stools $\rightarrow$ constipation - under feeding.
 $\rightarrow$ Diarrhea - overfeeding.

4. Test Feed:

- Weighing the baby before & after each fed for 3 successive days.
- The average increase in wt / feed is then calculated.
- If the average is less than the amount supposed to be taken by the baby $\Rightarrow$ the cause should be searched for; either in the mother or in the baby.
- To differentiate between these, express the breast after each feeding $\rightarrow$

If no milk is present

↓
Scanty milk production

if milk is present

↓
obstacles in the baby

5. “+ve Let down reflex” Milk-ejection Reflex $\Rightarrow$ Appearance of milk in the other breast during suckling is a good indicator of efficient milk production.
6. Chemical analysis of milk for its protein, CHO & lipid content.

Under Feeding

Etiology

I. In breast fed infants

⇒ the cause is either in the infant or in the mother "see obstacles of breast feeding".

II. In artificially fed infants

⇒ the cause is either insufficient amount of milk, or too diluted concentration of the formula.

C/P

1. The infant is not satisfied after feeding, doesn't go into sleep, always crying before and after feeding, & suckling his fists between feeds (hunger).
2. Failure to gain weight, then loss of weight.
3. Constipation, with few small & hard stools.
4. Oliguria + signs of dehydration.
5. Pallor
6. Test feed.
⇒ below normal

t t t

1. In breast fed infants

⇒ t t t of the cause.
+ complementary feeding.

2. In artificially fed infants

⇒ Correction of both the quantity & quality of the formula.

Over - Feeding

Etiology

I. In breast fed infants.

1. ⇒ Frequent feeding
2. ⇒ prolonged nursing time.

11. In artificially fed infants

1. → Concentrated formula
2. → Excessive amount

C/P

1. Vomiting esp. after feeding & crying due to colic & flatulence
2. Over-weight infants.
3. Diarrhea with large bulky & offensive stools.
4. Polyuria + sore buttocks.
5. Test feed ⇒ Above normal.

t t t

I. In breast fed infants.

- ⇒ Regulation of feeding &
Limitation of nursing time to 20 minutes.

II. In artificially fed infants

- ⇒ Correction of both quantity & Quality of feeding.

Stages of Milk Secretion

A. Colostrums

- ⇒ For 2-4 days after delivery

B. Transitional milk

- ⇒ 5-20 days after delivery

C. Mature milk " fully established

- ⇒ 3 weeks after delivery.

Colostrums

Definition

It is the secretion of the breast during the 1st 2-4 days after birth. This secretion may start few days before birth.

Character

1. Color $\Rightarrow$ Yellowish (β -Carotene).
2. Reaction $\Rightarrow$ Alkaline.
3. Specific gravity $\Rightarrow$ 1040
4. Amount $\Rightarrow$ Varies between 2 & 20 ml / feeding during the 1st 3 days, then it increases & can be as high as 100 ml.

Compositions

1. Protein $\Rightarrow$ 2.7 gm /dl
2. Fat $\Rightarrow$ 2.9gm /dl(It has less total fat & higher cholesterol which gives it the yellow color than mature milk).
3. CHO $\Rightarrow$ 5.3 gm /dl (It has less lactose than mature milk).
4. Ash $\Rightarrow$ 0.5 gm /dl (the concentrations of Na, K & Cl are greater than those of mature milk).

Microscopic Picture

1. Colostrums corpuscles, lymphocytes, PMNL & Fat globules
2. The colostrums corpuscles disappear normally with establishment of mature milk.

N.B

• Persistence or reappearance at any time during lactation is an indication that milk production will stop.

Advantages

1. Highly nutritive.
2. Suitable composition.
3. High Antibody content "esp. IgA" & Leukocytes.
4. Better involution of birth canal $\Rightarrow$ due to early suckling.
5. Natural laxative effect : It facilitate passage of meconium because of high oligosaccharide content..

Mature Breast Milk

Characters

- | | |
|-----------------------|-----------------------|
| 1. <u>Color</u> | $\Rightarrow$ White |
| 2. <u>Consistency</u> | $\Rightarrow$ Thin |
| 3. <u>Reaction</u> | $\Rightarrow$ Neutral |

- | | |
|----------------------------|-------------------------------|
| 4. <u>Specific gravity</u> | => 1030 |
| 5. <u>Amount</u> | => up to 1-2 Liters /D |
| 6. <u>Microscopically</u> | => small, fine, fat globules. |
| 7. <u>Caloric value</u> | => 67 cal / 100 ml |

Composition

A. Quantitative

1. Water → 88 %
2. Solids → 12 %
3. Calories → Each 100 ml supply 67 cal.
"150 ml = 100 cal. Or 3ml = 2 cal".
4. Protein → 1 - 1.5 gm/dl
5. Fat → 3.5 gm /dl.
6. CHO → 7gm /dl
7. Ash → 0.25 gm /dl

B. Qualitative

1- Proteins:

- Composed of
 - a. 60% are soluble "lactalbumin + lactoglobulin"
 - b. 40% are insoluble "caseinogen"
- Casein curd in human milk is fine, thin & easily digested.
- Contains all the essential A.A. in suitable proportion, including "Taurine" which is essential in low birth weight.
- It has lower phenylalanine, tyrosine & methionine level (newborn has lower levels of enzymes necessary for their metabolism).
- It is rich in cystine.
- Other important breast milk proteins:
 - a. Lysozymes.
 - b. Lactoferrin.
 - c. Immunoglobulins, hormones & hormones.
 - d. Zinc & copper binding proteins & transferring.
 - e. Epidermal growth factor.

2. Fat:

- Small size of fat globules.
- Small amounts of volatile F.A. "only 1.3% of total".
- High percentage of essential F.A. "Poly-unsaturated F.A. = 8% of total fat"

- The lipid content of breast milk varies according to many factors, e.g. within the feed (the hind milk has more fat than fore milk), stage of lactation, weaning, diurnal rhythm & gestational age at birth.
- They contain lipase (facilitate digestion of fats).
- They contain cholesterol which is essential for brain growth, bile acid & hormonal synthesis.
- They contain Omega-3 long chain fatty acids which is essential for brain development.

3. CHO:

- Beta – lactose is the only CHO of milk.
- Lactose is specific for newborn growth. It enhances Ca & iron absorption, so it has a role in prevention of rickets & iron deficiency anemia.
- Lactose favors the growth of lactobacillus bifidus which gives lactic acid which decrease growth of E-coli.
- Lactose is the source of galactose that is essential for production of galactolipids which is essential for brain growth.
- Oligosaccharides decrease the incidence of infection....see before.

4. Minerals:

- Ca : Ph ratio is 2:1 which is optimal for absorption (about 70 % of it absorbed while 25% of Ca absorbed from cow milk). So hypocalcemia & tetany is more common in cow's milk fed infants.
- Cow's milk also has higher phosphorus concentration that impair Ca absorption.
- Iron & Copper are deficient. But in spite of this, its biological availability for absorption is high, So no deficiency occurs in breast fed infants in the 1st year.
- Breastfed infants do not have the risk of iron loss, as do infants fed cow's milk because they may have microhemorrhages of the bowel as a result of mucosal damage by non human milk.
- Early introduction of solid food impair iron absorption from breast milk.
- Iron supplementation is usually not needed for breastfed in the 1st 6 months.
- Excess iron will saturate lactoferrin & diminish its anti-infective properties.
- Zinc is essential as an enzyme activator. Its level in breast milk

rise to peak level in the 2nd day.

- Zinc requirements are relatively high in the very young infant & decrease as the infant's age increases.

5. Vitamins:

- As lactation progresses, the level of water-soluble vitamins increases & the level fat-soluble vitamins decrease.
- Vit-A are present in an adequate amounts & it is main source of vitamin-A in developing countries even after the 1st year of life.
- It contains inadequate amount of Vit- C,D,K.
- Human colostrums & mature milk are rich in vitamin E., it is an antioxidant; so it protects all membranes in the retina & lungs against oxidant induced injury.
- Vitamin E deficiency will cause hemolytic anemia, especially in premature infant.
- Early ingestion of breast milk enhances growth bacterial flora which produce vitamin K.

6. Buffer Value:

Human milk has a lower buffer value than cow milk, thus it is easily digested because it doesn't need high gastric acid.

Comparison between human & Cow milk

	<i>Human milk</i>	<i>Animal milk</i>	<i>Formula</i>
<i>Protein</i>	Correct amount easy to digest	Too much difficult to digest	Partly corrected
<i>Fat</i>	Enough essential FA, lipase to digest	Lacks essential FA, no lipase	Lacks essential FA, no lipase
<i>Vitamins</i>	Enough	Not enough A & C	Vitamins added
<i>Minerals</i>	Correct amount	Too much	Partly corrected
<i>Iron</i>	Small amount well absorbed	Small amount not well absorbed	Extra added not well absorbed
<i>Water</i>	Enough	Extra needed	May need Extra
<i>Anti-infective</i>	Present	Not present	Not present
<i>Growth factors</i>	Present	Not present	Not present

Q: How can you alter the casein in animals milk?

1. Boiling.
2. Dilution with water
3. Acidification.
4. Drying or condensation.

Calculation of the amount of milk needed

Age method "Rule of Tens"

- 1st day → 10 ml /fed.
1st week → ↑ 10 ml /fed each day.
1st Month → ↑ 10 ml /fed each week.
1st Year → ↑ 10 ml /fed each month.

During the 1st year of life the following equation is used ⇒

$$\text{Amount of milk / fed} = (\text{Age in months} \times 10) + 100$$

Weight method

$$\text{Amount of milk / fed} = (\text{Wt "Kg"} \times 20) + 20$$

Caloric method

- The total caloric needs of the infant per day are calculated, then the volume of milk containing this amount is calculated.
- This volume is then divided by the number of feds.

N.B

- This is 'the most accurate method esp. during disease & malnutrition.

Artificial Feeding

Indications

1. Contra-indications of breast feeding.
2. Absent mother "death, travel, work, etc."
3. As complementary or supplementary feeding.
4. In feeding of twins.
5. Particular diseases : PKU, Galactosemia, lactose intolerance, HF, Nephrosis.

TYPES

A. Fresh animal milk.

B. Evaporated & condensed sweetened milks.

C. Dried milks.

1. Cream milk ⇒ full cream
Half cream
Skimmed milk
2. Acidified milk ⇒ Full cream
Half cream
Skimmed
3. Humanized milk
4. Protein milk
5. Special types of milk
 - Hypo- allergenic milk
 - Salt-free milk
 - Lactose - free milk
 - Phenyl- alanine free milk
 - Premature milk Formula.

Fresh Animal Milk

When fresh animal milk is used for infant feeding the following points should be considered:

1. Calculate the amount of each fed.
2. No. of feds / day.
3. Modifications of milk to approximate human milk "Humanization"
4. Sterilization of milk ⇒ by boiling for 15 minutes or by pasteurization, which is heating at 62°C for 1/2 hr then rapid cooling ⇒ This kills most of the bacteria.

Q: How to humanize buffalo milk?

- This is done by dilution of milk by water in 1: 1 ratio, and addition of 6 gm sucrose /dl & boiling of the milk.
- This approximates its composition to that of human milk, regarding the protein & caloric contents.
- Moreover, dilution & boiling help to modify the casein curd, rendering it less tough & more easily digested.
- Also, the fat contents is lowered, and the fat globules are rendered' smaller. So they are more easily digested.

Composition	Buffalo	After Humanization	Human
Protein "gm/dl"	4	2	1.2
Fat "gm/dl"	6	3	3.5
CHO "gm/dl"	4	2.6 gm sugar	7
ash "gm/dl"	0.9	0.45	0.25
Calories / dl	100	67	67

Evaporated & Condensed Sweetened Milks

- These are made of cow milk after being concentrated.
- In sweetened milk sucrose is added in a high concentration.
- They are usually used by adults not by infants.

Advantages

1. Alteration of casein.
2. Can be kept sterile for long periods.

A. Evaporated milk

⇒ is prepared by dilution
1: 5 in water.

B. Condensed milk

⇒ is prepared by dilution 1 : 5 in water.

Dried Milks

Methods of preparation

1. Roller method
2. Spray method

Advantages

1. Sterile & easily stored.
2. Easily handled & can be prepared fresh for every fed.
3. Constant in composition.
4. Drying renders the curd softer & smaller.
5. Can be fortified with vitamins & minerals.
6. Different types are available for different ages & diseases.

Types

A. Cream Milks

- I. Full cream: fat content 4 gm%

Indication:

1. Completely healthy infants over 4 months age.
2. In cold weather because of high caloric contents.
e.g. Nestogen full cream

- II. Half cream: Fat content 2-3 gm%

Indication:

- Healthy infants less than 4 m.
e.g. Bebelac Z12.

- III. Skimmed milk: Fat content 0.5-1 gm% (not available)

Indication:

1. Fat intolerance & malabsorption.
2. Convalescence from diarrhea .
3. Prematurity.

B. Acidified Milks:

Methods of acidification

1. Chemical $\Rightarrow$ lactic acid.
2. Biological $\Rightarrow$ by fermentation using lactobacillus acidophilus or lactobacillus bulgaricus.

Advantages.

1. Easily digested $\Rightarrow$ Why?
2. Casein is altered into fine curd.
3. Acidity enhances Ca^{2+} absorption.
4. Disinfectant effect on GIT
5. Shorter stay in stomach $\Rightarrow$ So it is indicated in cases of vomiting.

Indications:

1. Infants with digestive troubles.
2. Recovery from diarrheal diseases.
3. Premature & Low birth weight.
4. Protein calorie malnutrition.
5. Habitual vomiting.

TYPES

1. Acidified full cream
2. Acidified half cream.
3. Acidified skimmed.

N.B

- Skimmed milks have low caloric content (Low fat).
So, not suitable for prolonged periods.

C. Humanized Milks

The following modifications have been done:

1. Proteins, CHO, fat have been roughly approximated to human milk.
2. Protein is modified to form soft, small curd to be easily digested.
3. Mineral content is lowered to approximate human NaCl content, while Ca/p ratio is optimized to be 2/1
4. Vitamins & Iron are sometimes added to fortify milk.

Indications: In Feeding of healthy infants

e.g. Similac, SMA, S26, Enfamil NAN, Bebelac I.

Protein Milk:

- This is prepared by addition of dry casein to Butter milk.
- It has a low CHO & low caloric value.

Composition:

- | | | |
|------------|---|--------|
| 1. Protein | ⇒ | 5 gm |
| 2. CHO | ⇒ | 3.5 gm |
| 3. Fat | ⇒ | 2.5 gm |

It can not be used for a prolonged time due to.

1. It's bad taste.
2. Causes constipation.
3. Expensive.
4. Has low caloric value.

Indications

1. Diarrheal diseases.
2. Debilitated infants.
3. Preterm babies.

N.B

It is prepared by addition to rice water or an adapted or any special formula .

Special types:

1. Hypo-allergenic milks (vegetable milk).

- Indicated in: infants allergic to human & animal proteins, Lactose intolerance & galactosemia.
- Vegetable protein "Soya protein " is used to replace the milk protein & the lactose of milk is replaced by other sugar (Sucrose or glucose) e.g. Nursoy, Isomil.

2. Salt - Free milks

Indications

1. HF
 2. Congenital Nephrosis.
 3. Steroid therapy.
- e.g. Lonalac

3. Lactose Free milks

Indications

1. Galactosemia.
 2. Lactose- intolerance.
- e.g. Isomil

4. Phenyl-alanine free milks

Indications:

⇒ PKU

e.g. Lofenalac

5. Premature milk formula.

Contains 80 Cal / dl

It is used to promote & support increased nutritional needs of the premature baby.

e.g. Pre NAN, Enfamil LBW.

6. Predigested milk (elemental):

Indications:

- Intractable diarrhea.
- Protein losing enteropathy.
- Malabsorption due to pancreatic & biliary insufficiency.

In these formula the protein is present in the form of amino acids; fat in the form of medium chain triglycerides & CHO in the form of glucose polymers.

Disadvantages:

- a. Bad taste.
- b. Constipation.
- c. Expensive.

Weaning

Definition

Addition of solid & semisolids foods other than milk to the feeds of the baby.

Time of weaning.

Usually started at the age of 4 months to be complete at 1-2 years. After the age of 4 months. Milk is not a sufficient diet for the infant.

Addition of new food should be postponed in the following conditions.

1. In very hot weather.
2. Convalescence from any disease.
3. Following G.E.
4. During eruption of new tooth.

Principles of weaning.

1. Added food should be initially nearest in composition & taste to milk as pudding & yogurt.
2. Any new food should be offered initially once a day in small amounts until the whole feed is replaced.
3. Attractive plates & colorful arrangement to stimulate the babies interests.
4. Foods should be sieved strained or pureed at the start of weaning "thin consistency.
5. Feeds should be freshly prepared "for fear of contamination.
6. Additions should be tried separately i.e. no more than one new food should be given at a time week.
7. Additions should be given at a fixed time of the day. This helps the development of the conditioned reflexes of GIT.
8. If the baby dislike the new food, $\Rightarrow$ it should be omitted and tried in another occasion, some weeks later.
9. The first feed to be replaced is the mid-day fed & the last feed to be replaced are the 1st & last. They should stay milk to the end of weaning.
10. Additions should be given with a spoon or with cup.
11. It should be emphasized that there's no strict rules for weaning However this principles help to perform a successful program.